Maintenance Issues for Remote Communities: The Battery Problem

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Example: Lead-Acid Batteries

- Batteries are the most common failure point: the “soft underbelly” of rural electricifaction projects requiring decentralized energy storage.
- Can we organize a battery maintenance system cheaply and relying on local capacity?
- Models for Recovery & Recycling
  - *Important for human & environ. health*
  - *Markets may be beginning to respond in developing country settings*
- Big question: How to enable safe and informed decisions regarding unfamiliar technologies?

Battery Lifetimes: Operational Issues

- Programmes have often lacked sensitivity to audience:
  - service not aligned with actual needs
  - unclear responsibilities
  - tariffs which bear little relation to actual cost
  - suppliers that participate at the point of sale only
- User abuse, due to:
  - inappropriate incentives
  - lack of knowledge
  - lack of oversight

Batteries Are Not New Technology

Robert William Vicarey, a pioneer of industrial processes in battery manufacture from the turn of the century through the 1930's, noted in 1923:

"Having been upwards of 16 years associated with the manufacture of accumulators, and having during that period inspected a great number of installations of various makes and types, I have been greatly surprised at the alarming number of cases where the persons in charge have been entirely ignorant of the of the management or treatment of their batteries."

from Kathryn Bullock, "The Writings of Robert William Vicarey: A Personal History of the Lead-Acid Storage Battery Industry", in Salkind (ed.) History of Battery Technology (Electrochemical Society, 1987)

Lead-acid Technologies: Still a Black Box?

- Same reaction:

$$PbO_2 + Pb + 2H_2SO_4 \Longleftrightarrow 2PbSO_4 + 2H_2O$$

- Different grid plate designs, paste alloys, pressure regulation, reservoir capacities, electrolyte suspension mechanisms, etc.
- These affect charge regulation voltages, impedance, overcharge tolerance, etc.
- However, the end user only knows: “my battery is not working like it used to”.

Today: Types of Applications

- Simple battery-only systems, charged at end-of-grid points
- Battery charging stations
- Dedicated PV systems
- Hybrid power systems
- Diesel-powered grids and other Stand-alone RPS

Battery Service Shops

- Present in medium-sized towns and peri-urban areas in many parts of the developing world.
- Major niches are SLI batteries for trucks & cars, and small batteries for rural use
- Often small, unregulated businesses
- Also provide ‘maintenance’

Battery Charging Stations

- Attractive for centralized admin.
- Can be complex to manage
- Excess capacity often means high cost/low effectiveness
- Batteries suffer tremendously...

Stand-alone PV Systems (SHS)

- Most widely disseminated renewable energy technology
- Battery tends to be the limiting factor (1-5 years)
- Replacement is a large part of system LCC

Hybrid Power Systems

- Typically more robust due to multiple power sources.
- Larger, more specialized batteries
- Lower battery ‘autonomy’ due to better load-tracking

Urgently Required: Appropriate Education

- Many Levels: Family members (users), Technicians, Systems designers, Installers, Suppliers, Planners…..
- From the pre-decision stages onward. The issue is “ownership”
- Frequent and Sustained
- Appropriate settings and languages, close to the audience
- This is most difficult for disbursed technologies

Pointers for Program Designers

- Include a realistic budget for maintenance and recurring costs in program planning and/or business plan, and follow through with this. *(often this is the first item to be cut from lean program budgets!)*
- Make sure the users can and are willing to pay this portion of the service cost--whether or not they must cover initial equipment costs
- Use repetitive and sustained education to reinforce awareness of the long-term requirements of remote power systems.